



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Fifteenth Annual Report
of the
Sugarcane Research Station
1944



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J. H. BOWKETT, GOVERNMENT PRINTER,
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SUGARCANE RESEARCH STATION, MAURITIUS
15TH ANNUAL REPORT 1944

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The Senior Chemist.
The Botanist.
The Geneticist.

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Mr. Frederick North Coombes.
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Nominated by the Sugar Industry Reserve Fund Committee :

Mr. Doger de Spéville.
Mr. P. de Sornay, Chevalier de la Légion d'Honneur.

Fifteenth Annual Report of the Sugarcane Research Station for the year 1944

INTRODUCTION

During the year under review, the staff of the Station was again below strength on account of war duties, not connected with sugarcane research, which some officers were called upon to perform. In this connection Dr. Evans remained seconded for duty at the Information Office throughout the year, and Mr. d'Emmerez was engaged in manioc drying experiments, returning to his normal duties on 20th September, 1944. Later in the year, he was promoted to the post of Agronomist in the Agricultural Division, and he assumed duty on 14th December, 1944. Mr. A. de Sornay, who had been acting as Registrar of the Agricultural College, was confirmed in this post on 29th February, 1944, from which date the post of Cane Breeding Officer was abolished. Mr. P. Halais was released from military service on 15th January, 1944, in order to enable him to recommence research work. As a result, therefore, research work has again been reduced because of the shortage of staff but there was a definite increase compared with the previous year. Once again cane breeding has been continued at the usual rate, although no new cane variety was released for general distribution during the year. Mr. Halais' return enabled chemical investigation work to be resumed particularly with respect to foliar diagnosis, and the quantity of plant food elements, including nitrogen, phosphoric acid, potash, calcium and magnesium, contained in the harvested parts of the sugarcane at the time of harvest. During the portion of the year that Mr. d'Emmerez's services were available, a start was made in tackling the problem of weed infestation of cultivated lands, a problem which has assumed serious proportions during the past two years.

A survey of the area under cane varieties bred by the Sugarcane Research Station carried out in March 1944 showed that of the area surveyed about 54 per cent. was then cultivated in the four varieties M.171/30, M.72/31, M.134/32 and M.112/34, the M.134/32 being predominant with about 36 per cent., M.171/30 following with about 13 per cent. Thus it would appear that the sugar industry of Mauritius is dependent for the first time on locally bred canes rather than on imported ones, and there is every prospect that the area under them will still further be increased. There is evidence that the last variety released, M.112/34, will also be planted on an increasing scale in the future.

Only one meeting of the Research Advisory Committee was held during the year, in October, when the questions of staff and research programmes were discussed.

Weather conditions for the 1944 crop were variable. The severe drought of September to November, 1943, definitely retarded growth of the newly cut canes, but during the next five months, December 1943 to April 1944, rainfall was in excess of the average. This period was characterized by extremely heavy precipitations, causing heavy flooding of the rivers, alternating with dry periods. For instance, the amount of rain falling during some of the heavy rainfall periods at Réduit are given below—

December ...	27th to 29th, 1943 (inclusive)	8'0 in.	(approx).		
February ...	8th to 10th, 1944	do	9'9 in.	do	Cyclone.
March ...	9th to 11th, 1944	do	10'1 in.	do	
April ...	8th to 14th, 1944	do	12'1 in.	do	Cyclone.

These excesses were certainly not favourable for optimum cane growth, irrespective of any damage caused by the wind during the two cyclones. The February cyclone did not damage the canes to any great extent, whereas the April cyclone did, the official estimate immediately after the cyclone being 12 per cent. loss. Unfortunately during the succeeding two and a half months, i.e., up to the end of June, rainfall was deficient (at Réduit 0'92 in. for May and 1'90 in. for June) with the result that the crop had very little chance of recovering, and indeed little growth was observed after the April cyclone. Rainfall from July to mid-October was generally above normal, but from then up to mid-December a severe drought prevailed, November being a particularly dry month. Temperature was in nine months during the year above the average, and was below the average during the month of May only. Climatic factors were prejudicial to optimum growth of the cane crop, and these factors combined with the late finish of the 1943 crop, labour shortage resulting in late and poor work in the fields, abnormal weed infestations, and late and reduced fertilizer applications, resulted in a very serious reduction of the sugar crop, amounting to about one-third of the previous crop. It should be remarked that in addition to the causes mentioned about an extra 5 per cent. of cane lands was taken for food production. Prospects for the 1945-46 crop are at present satisfactory as work is well in hand due to the early finish of the 1944-45 crop, ratoons got a good start due to the rains in September and early October and increased quantities of fertilizers have been released at a much earlier date than for the 1944-45 crop.

Rainfall figures for the three stations are—

1944 Months	Pamplémousses Experiment Station. Rainfall		Central Experiment Station, Réduit			Royal College, Curepipe	
	Rainfall		Rainfall		Temperature above(+) or below(-) normal	Rainfall	
	Average	1944	Average	1944		Average	1944
January ...	9'56	3'74	10'32	6'59	+0'3	16'33	8'83
February ...	8'74	8'03	10'95	13'99	+0'3	17'28	20'08
March ...	9'32	17'03	11'94	20'02	+0'2	19'31	43'96
April ...	5'96	8'10	5'41	15'78	0'0	12'39	21'33
May ...	4'48	1'19	4'24	0'92	-0'2	9'86	3'42
June ...	3'43	1'10	3'11	1'90	+0'8	7'47	6'29
July ...	2'93	2'79	2'75	3'91	0'0	8'57	9'36
August ...	2'59	0'77	2'47	1'40	+0'4	7'79	4'07
September ...	1'83	3'32	1'71	3'98	+0'9	5'78	10'01
October ...	1'95	2'53	1'91	2'45	+1'3	4'32	5'83
November ...	2'13	0'53	2'33	0'36	+1'2	5'71	2'29
December ...	4'91	6'90	6'39	9'10	+0'2	9'71	8'84
Total ...	57'83	56'03	63'53	80'40		124'52	144'31

The Geneticist in addition to his cane breeding work, has also been responsible for a subsidiary line of research, that of improving the local maize, and several superior strains have been selected. The officer in charge of the Station who continued to act as Assistant to the Director of Agriculture throughout the year, was in charge of food production on estates of between 20 and 200 arpents, and has also been responsible for the scheme for distributing chemical fertilizers made under the general direction of the Controller of Supplies.

A new post has been created in the Sugarcane Research Station, namely that of "Field Assistant in Charge of Cultural Methods." As Mr. d'Unienville was appointed to the post only at the end of the year, no work has so far been started. It will be the duty of this officer to carry out demonstrations on small planters lands with the object of improving their methods of cultivation and manuring, with the object of improving their yields per arpent. It is confidently expected that a big improvement may be made in this direction with corresponding advantage to the small planters and to the Colony in general.

In conclusion, I would like to extend to all managers of estates who have co-operated with us in our work in spite of the many difficulties, the warmest thanks from all members of the staff.

N. CRAIG, *Officer-in-charge,*
Sugarcane Research Station.

PART I—GENETICIST'S DIVISION

I. Cane Breeding—M./44 Series

Breeding work was carried out at Reduit and Pamplémousses Experiment Station during May and June under favourable conditions.

All crosses were controlled, and made in small single-arrow lanterns as in previous years. No change was made in the sowing and potting technique, but in order to economise in transport, fuzz of many Reduit crosses (rather than box-stage seedlings) was sent to Pamplémousses Experiment Station and sown there to provide seedlings for the first year trial.

Seventy-five lanterns were used at Reduit, and fourteen at Pamplémousses Experiment Station, and at both stations the proven crosses were duplicated, triplicated, and in some cases quadruplicated to ensure adequate populations of seedlings for trial.

Although several new experimental crosses were made, the majority of crosses were between proven parents, the seedlings from which also occupied a greater part of the first year seedling plantations than in previous years.

Fuzz germination and seedling growth were satisfactory, and at both Stations the field plantations were completed before the end of December.

A list of crosses made, seedlings obtained and planted, is given, in summarized form, below—

	No. of crosses made	No. of lanterns used	No. of seedlings obtained	No. of seedlings planted	
				C.E.S.	P.E.S.
1. Noble cane breeding (<i>S. officinarum</i>) ...	1	1	305	175	55
2. Nobilisation of <i>S. spontaneum</i> (Java)					
(a) 4th nobilisation ...	3	5	907	431	128
(b) 5th nobilisation ...	13	28	10,080	3,617	827
(c) mixed "glagah" crosses ...	2	3	2,390	612	461
3. Crosses involving several <i>Saccharum</i> spp.—					
(a) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java) and <i>S. spontaneum</i> (India) ...	17	32	8,922	2,112	1,870
(b) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java) and <i>S. barberi</i> ...	1	2	90	74	0
(c) <i>S. officinarum</i> , <i>S. Spontaneum</i> (India) and <i>S. barberi</i> ...	1	1	700	178	52
(d) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java), <i>S. spontaneum</i> (India) and <i>S. barberi</i> ...	4	9	2,883	240	775
(e) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java) and <i>S. officinarum</i> (Celebes) ...	1	1	900	0	171
(f) <i>S. officinarum</i> , <i>S. spontaneum</i> (Java) and <i>S. robustum</i> ...	7	7	4,009	1,043	567
TOTALS ...	50	89	31,186	8,482	4,906

Crosses in the fifth "glagah" nobilization series and in the *officinarum*—*spontaneum* (Java)—*spontaneum* (India) group again predominated, occupying in all 60 of the 89 lanterns used.

The breeding line including *S. robustum* blood was increased in scope, and excellent germination was again obtained in these crosses. One population of second-generation *robustum* hybrids reaped at Pamplémousses Experiment Station in November yielded several seedlings of promising type and satisfactory juice quality, though further hybridization might be necessary before commercial varieties are obtained.

The seedlings from the various crosses were, for the main part, planted in the field in compact blocks as in previous years. At both Stations, however, a special trial was laid down to assess the degree of variability in seedling populations, and to test the relative merits of distinct crosses in various respects. In these trials one hundred seedlings from each of nine crosses were planted at random, together with one hundred sprouted single-eye cuttings of the standard variety M.134/32. At harvest it is proposed to record individual stool weights, cane numbers, brix values, etc., for population comparisons. Figures for variability in the clonal material of M.134/32 will also be recorded.

II. First Year Trials

(a) *Virgins*.—M./43 Series.—At Réduit, the virgin seedlings were again cut without selection, having made only indifferent growth. At Pamplémousses Experiment Station fifty seedling selections were made from a total population of 5,099, or approximately 1 per cent.

(b) *Ratoons*.—M./42 Series.—At Réduit, seventy-four selections were made from the ratoon population of 7,547 seedlings cut without selection in 1943, or about 1 per cent. Corresponding figures at Pamplémousses Experiment Station were fifty-two selections from 4,625 seedlings, or 1.1 per cent.

All first year selections were planted as single rows in multiplication plots, which also serve the purpose of an additional intermediate selection stage, where seedlings of bad type, or showing susceptibility to disease, are eliminated before planting second year trials.

Various data on population performances in the first year trials were obtained. This information is valuable for progeny testing purposes, thereby guiding the choice of parent varieties in future breeding, but for reasons of economy in space it must be omitted from this report.

The principles of ratoon selection, and its merits in comparison with selection of virgin populations, have been briefly considered in the 1942 and 1943 reports, and the experience gained at the 1944 crop in regard to ratoon selection did not differ materially from that which has been recorded. The policy in seedling selection at present is to rely on ratoon selection at Réduit, where it is difficult to obtain a mature virgin seedling crop, but to continue both virgin and ratoon selections at Pamplémousses Experiment Station where the shorter and less pronounced cold season generally allows of adequate development in December-planted virgin seedlings.

Seedlings selected from M./40 ratoons in 1942 have now passed the second year trial stage, and notes on the performances of these are to be found in the following section.

III. Second Year Trials

At Réduit, eleven second year trials were laid down in March–April for *moyenne saison* growth of M./41 seedlings cut from multiplication plots. At Pamplémousses Experiment Station four trials were planted in July–August to test the surviving M./41 ratoon-selected seedlings of the Pamplémousses series in *petite saison*, and three at the same season for M./42 virgin selections.

The M./40 series of seedlings in eleven second year trials were reaped at Réduit—six trials containing original selections from virgins, and five from ratoons. Eleven seedlings were selected for inclusion in third year trials, from a total of 68 under trial.

At Pamplémousses, there were seven trials of M./41 seedlings from original virgin selections, and five of M./40 ratoon selections. Here, 18 selections were made from the 96 seedlings tested.

Selection criteria in second year trials were cane yield (from four replications) refractometric brix value, extent of arrowing, and resistance to such diseases as were present, and in all cases the standards for comparison were the high-grade commercial varieties M.134/32 and M.112/34.

Seedlings originally selected from ratoon populations figured in the second year trial scheme for the first time, and the opportunity was taken to observe their behaviour in comparison with that of seedlings from original virgin selections in similar trials. Generally speaking, the ratoon-selected individuals were of good type at both stations, and the percentage of selections was comparable with that from virgin-selected seedlings. Degree of arrowing was markedly low in these seedlings, and it is concluded that the modification in selection technique introduced in 1942 is fully justified. The two outstanding selections from second year trials—M.308/40 (M.112/34 × D.109) at Pamplémousses, and M.405/40 (M.134/32 × M.27/16) at Réduit—are both ratoon-selected individuals.

As stated above, ratoon selection of seedlings has replaced selection in virgins at Réduit. At Pamplémousses, where selection is practised at both stages, a new series of second year trials has necessarily been introduced. However, the additional work and expense involved is fully justified by the opportunity thereby provided for more critical selection at this important stage.

IV. Third Year Trials

Third year trials were reaped in first ratoons at both stations—two trials at each.

At Réduit, the varieties M.101/37 and M.102/37 previously selected and already planted in some estate variety trials, yielded only moderately and gave juice qualities approximately equal to that of M.171/30, which is a borderline case in this respect. It appears unlikely that either will be of value for commercial growing. At Pamplémousses Experiment Station, the selected varieties, M.63/39, M.65/39 and M.76/39, all outyielded the standard varieties M.134/32 and M.112/34 by a clear margin. They were slightly lower in sucrose per cent. cane, but definitely superior in yield of sugar per acre. A fourth variety previously selected—M.4/39—also gave a satisfactory performance in ratoons. Reference is made to these potential commercial varieties in Section V of this report.

Four third year trials for the crop of 1945 were planted during the year—two in *moyenne saison* at Réduit, and two in *petite saison* at Pamplémousses.

One of the trials at Réduit includes the five surviving varieties of the first series selected for poor soil conditions. In this trial, interest is centred mainly in the performance of M.41/38, a variety of complicated parentage including B.H.10(12), P.O.J.2878 and Uba Marot, and which in all its trials to date has given juice qualities unprecedented in the writer's experience. Its sucrose per cent. cane in first ratoons in 1943 was almost 19 per cent.

The Pamplémousses trials contain 13 varieties. These are the survivors from 23 selections from second year trials in 1943, after eliminating those susceptible to gumming disease or found to exhibit undesirable characters in the multiplication plots. These 13 varieties of the M./40 series are among the most promising bred by the station, having given outstanding yields and juice qualities in their second year trials, as shown in the following table—

Variety	Parentage		Results in Second Year Trials 1943		
			Tons cane per acre	Refractometric brix	
M. 171/40 ...	Ba. 11569 × M. 72/31	...	42·7	...	23·4
M. 173/40 ...	do do	...	33·8	...	24·1
M. 176/40 ...	do do	...	32·6	...	24·7
M. 194/40 ...	M. 112/34 × D. 109	...	35·1	...	23·9
M. 198/40 ...	M. 20/16 × M. 72/31	...	30·8	...	24·1
M. 204/40 ...	Ba. 11569 × M. 72/31	...	43·8	...	23·0
M. 205/40 ...	M. 134/32 × M. 109/26	...	44·3	...	21·9
M. 213/40 ...	M. 134/32 × M. 99/34	...	36·4	...	24·8
M. 214/40 ...	do do	...	29·4	...	24·8
M. 215/40 ...	M. 188/33 × M. 99/34	...	33·0	...	24·3
M. 218/40 ...	do do	...	40·3	...	24·3
M. 233/40 ...	M. 134/32 × M. 99/34	...	31·5	...	23·2
M. 234/40 ...	do do	...	34·7	...	23·2
M. 134/32 ...	Standard	...	26·6 ± 1·3*	23·78 ± 0·06*	

*mean of five trials

The results of these two trials in 1945 are awaited with interest. One variety—M.198/40—is peculiar in having triple buds at most of its nodes, a feature which was noticed on its original selection in 1941, and which has persisted in subsequent plantings.

The field technique of third year trials remained unchanged. Laboratory analyses of cane samples were done, however, with a Cutex shredder, which gives more reliable figures both for juice quality and fibre than the miniature cane mill previously used, whose extraction capacity was somewhat low and in which bagasse was not reduced to a fine state of division.

V. Variety Trials

The growing season was abnormal in several respects, and was not a favourable one for sugarcane growth. Rainfall and temperature figures are given in the introductory section by the Officer in charge Sugarcane Research Station, and from these it will be noted that conditions for early growth were good, with abnormally heavy rains in January, February and March. Consequently, the canes were well advanced at the time of the early April cyclone, and suffered considerable damage. Moreover, the injurious effects of this cyclone were intensified by the conditions of virtual drought which followed in May and early June: cane tonnages at crop time revealed that the original estimates of cyclone damage had been too low. Cyclonic rains again occurred in September—a rare occurrence in Mauritius—and delayed cane ripening to some extent.

The effects of the peculiar seasonal conditions on disease development are the subject of comment in a later section of this report. The more important results of variety trials reaped during the 1944 crop are given in the following synoptic table. Fourteen trials were reaped—two in virgins, six in first ratoons, and six in second ratoons: for the virgin trials cane analyses are not available, as the trial at Pamplémousses Experiment Station was cut at 9 months to provide planting material for further estate trials, while from that at Terracine the variety samples had deteriorated due to delay in transport to the laboratory. One first ratoon trial at Reduit included only the normal, the striped and the white modifications of M.134/32. No significant differences in yield or juice quality were found (as in the case of the virgins) and the results are not tabulated.

In view of the unfavourable season, the figures for M.112/34 are very satisfactory. Its yield—except in a few cases—was approximately as good as that of M.134/32, and its juice quality was significantly better. M.112/34 is in fact the best of the released Sugarcane Research Station varieties in juice quality. Its value as a commercial cane is summarized later in this report.

Of the M./36 series, M.7/36 and M.144/36 have both given good yields, but are too low in juice quality to be considered for release. M.163/36 is too low in yielding capacity. M.64/36 again gave fair yields and moderate juice quality. This variety is planted in several new variety trials in different districts, and the consideration of its commercial possibilities must await the crop of 1945.

During the year six further variety trials were planted. These contain the promising variety M.165/38, and the first four of the M./39 series to reach variety trial status, viz., M.4/39, M.63/39, M.65/39 and M.76/39. These are known to be excellent growth type and high yielding capacity, but have yet to be tested fully for juice quality under estate conditions.

VI. The M. varieties in commercial cultivation

Varieties bred by the Sugarcane Research Station now occupy more than one-half of the area under cane in Mauritius. Since 1941, the area under M. varieties has been almost trebled, in spite of a total reduction amounting to 27.5 per cent. in area under cane for all estates over 20 arpents, accounted for by foodstuff cultivation.

This rapid rate of increase in the cultivation of the Sugarcane Research Station varieties is a clear indication of their superiority over the older varieties, and of their value to the industry. The following brief notes give the particular merits of the more important varieties, and indicate the climatic regions where they are best suited.

M.171/30.—A noble cane, from the cross R.P.6 × M.27/16, released in 1936. This variety is of good growth type, tillers well, arrows very little, and gives good yields. In the coastal belt and the dry regions of the north, it is not well suited, particularly on account of poor juice quality. In the higher and wetter regions its juice quality is better, and it is extensively cultivated in Plaines Wilhems, Moka, and the higher regions of Flacq, Savanne and Grand Port. Some 7,000 acres are under M.171/30 at present on estates with mills.

M.72/31.—A “glagah” nobilization from the cross P.O.J.2878 × M.35/17, released in 1936. The area under this variety has remained stationary at about 1,500 acres on estates with mills since 1941, and it will probably be reduced rapidly as ratoon fields are re-planted in their rotation. The chief reason for this is that the variety has stiff hairs on the leaf-sheaths, and is handled only with reluctance by labourers at reaping. In other respects, M.72/31 is an excellent variety, with yield, juice quality and bagasse characteristics of a high order.

M.134/32.—Bred from the cross P.O.J.2878 × D.109, and released in 1937, this variety has proved the most popular of the *M.* varieties up to the present. It is a quick-stooling, vigorous grower, yielding a heavy crop of cane whose juice quality is good, and it shows considerable resistance to *Phylalus* and to droughts. While it is cultivated universally in the island, *M.134/32* has proved of exceptional value in the dry regions of the north, and is the small planters' cane *par excellence*. In these difficult war years, *M.134/32* has in fact proved a veritable life-giver to the agriculture of the Colony.

The chief demerits of *M.134/32* are heavy arrowing under certain conditions, some susceptibility to red rot disease, particularly when grown in *grande saison* plantations, and a low fibre percentage which sometimes results in poor bagasse returns and difficulties in factory economy where large tonnages are crushed.

Estates with mills had some 5,000 acres of *M.134/32* in 1941, and approximately 17,500 acres in 1944. In addition to this, it is estimated that other estates and small planters—whose cane acreage amounted in 1944 to about 73,000—were growing at least 24,000 acres of *M.134/32*. This variety occupied in all, therefore, some 41,500 acres, or about 34 per cent. of the cane area of the Colony.

M.112/34.—This variety, bred from R.P.8 × P.O.J.2878, was released in 1941, and is only beginning to find its niche in commercial cultivation. There were about 600 acres under cultivation on estates with mills at the end of 1944, and possibly an additional 100 acres or so on planters' lands. *M.112/34* appears best suited to lands of good quality where there is sufficient rainfall or irrigation water in and near the coastal belt: it is of little value in the colder, higher rainfall regions. It does not stool so early as *M.134/32*, and is less able to control weeds during its early months of growth: later, it grows very rapidly, arrows less than *M.134/32*, and generally gives good yields under the conditions stated above. Indications are that it gives excellent results in ratoons. *M.112/34* is particularly good in juice quality, frequently equalling BH.10(12): its canes are upright and clean, and it is easy to reap and load for transport.

In the field, red leaf-sheaths due to attack by *Cercospora vaginæ* are characteristic. This condition is not serious, and is not to be confused with red rot disease, to which *M.112/34* shows considerably greater resistance than *M.134/32*.

VII. Disease Resistance Testing

Gumming disease.—Routine resistance tests of all seedlings selected from second year trials were carried out, and although inoculation of the border controls was not done, there was sufficient natural infection to allow of positive assessments of susceptibility being made. Natural infection at Pamplémousses Experiment Station was more widespread

than usual. Some seedlings in second year trials showed leaf symptoms so well pronounced that they were discarded without the necessity of undergoing the routine trial later. Extensive attack by gumming disease was found at Pamplémousses Experiment Station in a population of first year seedlings of the *robustum* nobilization line from the cross Ba.11569 × M.71/40. Ba.11569 itself is highly susceptible, and evidently the *robustum* blood from M.71/40 confers little resistance, as only relatively few unaffected individuals were found.

Red Rot.—Conditions during the year were conducive to rather widespread red rot attack on all but the most resistant varieties—a situation which, though serious to the industry, was not without its beneficial aspect in variety selection work. Many seedlings which might otherwise have been included in later stage trials were discarded on account of their evident susceptibility to red rot disease.

A peculiar type of red rot attack was rather common on M.134/32 and certain varieties under test. This attack spread from initial points of infection at the knee-joints of canes laid down by the April cyclone and which had later turned upwards. The tissue first affected was the outer side of the growth ring at the point of bending, and the condition is described in more detail by Wiché in the *Revue Agricole*, November-December, 1944. It is desired to emphasize that this type of attack is abnormal, and that so severe an incidence is not to be expected in a more normal season.

VIII. Export of Fuzz

The Experiment Station of the South African Sugar Association at Mount Edgecombe and the Ministry of Agriculture at Cairo, Egypt, were both supplied with fuzz consignments from crosses which might yield seedlings suited to their particular conditions. Correspondence was exchanged with the authorities in both these countries on the subject of the performance of seedlings raised from fuzz sent in previous years.

IX. Maize Improvement Work

A brief account of the local maize type, and of the preliminary steps taken to improve its yielding capacity, was given in the report for 1943. Improvement work was continued during the year under review.

Estates were reluctant to undertake maize improvement work on the lines suggested to them, and it was necessary to extend the selection and propagation work done by the writer at the Tobacco Research Station, Richelieu, in order to provide larger amounts of improved seed maize for sale to growers.

Three main strains of local maize are being developed by the selective detasseling method. Seed of these strains has already been planted on estates.

Further tests of imported varieties have shown that none is of any use commercially under Mauritius conditions owing to lack of vigour and susceptibility to streak disease. Crosses and back-crosses between certain imported varieties and local selections have been made, however, and are being used as the basis of new strains which show promise. The most worthy of note among these are a back-cross of the dent variety Sahara, and a back-cross from pure lines of Teomaize (teosinte-maize inbreds kindly supplied by the Potchefstroom Station, Transvaal).

Pure lines isolated from local maize selections have been produced by selfing for three generations. These are approaching stability, and show spectacular differences in many characters, particularly vigour and time of maturity. The best among them will be multiplied during the next selfing in order to provide material for preliminary testing of interline hybrids.

G. C. STEVENSON,
Geneticist.

PARTS II and III

CHEMICAL AND BOTANICAL DIVISIONS

During the period when Mr. Halais was on military service, a considerable number of samples for analysis were accumulated, particularly leaf samples for foliar diagnosis from different categories of plantations and from manurial and variety trials. With the return of this officer in February, 1944, this foliar diagnosis work was immediately resumed, and with the additional results now to hand it is considered that the method is one of considerable value for advisory work. With this object in view it is hoped to lay down a number of factorial experiments ($3 \times 3 \times 3$) which will be followed over a number of years, and leaf analyses will be done on all the different plots to determine the optimum concentration of plant nutrients in the leaves of a predetermined rank. These trials will be planted with the standard variety at the time when the trials are started. Analyses of the cane plant at the time of harvest will also be performed, to find out how much nitrogen, phosphoric oxide and potash is exported—

- (a) in the millable cane,
- (b) in the cane tops which may be fed to animals,
- (c) in the trash.

Notes on the work done in the Chemical Laboratory have been prepared and are given below.

Work in the Botanical Division was very severely restricted throughout the year as Dr. Evans continued in his duties at the Information Office, and Mr. d'Emmerez was engaged for part of his time in the manioc drying scheme and later in the year was promoted to Agronomist in the Agricultural Division of the Department of Agriculture.

During the time that his services were available, a start was made in investigating the weed problem, but further work has had to be postponed pending the appointment of his successor. A short account of the work is given later.

Analysis of Cane Samples from Field Trials

The object of these analyses is to obtain reliable comparisons of the available commercial sugar from canes of different varieties or from canes grown with different manurial treatments.

The method elaborated for use during the crop of 1944-45 has been changed from that employed previously and is as follows: Samples were taken in the field from each individual plot, but on reaching the laboratory the samples from each variety or treatment were bulked and sub-sampled. The representative sub-sample was then shredded by means of a cane shredder, and then rapidly and thoroughly mixed. Part of the shredded material was then placed in a small hand press, and the juice expressed and collected. The juice was then analysed by usual methods for Brix, Polarisation and Apparent Purity. From the figures so obtained, the results were calculated on an absolute juice basis by means of appropriate factors. The moisture content of the cane was determined by taking 100 gms. of the shredded material and drying at 80°C overnight, and completing at 105°C for two hours. Moisture per cent. cane divided by moisture per cent. absolute juice multiplied by 100 gives absolute juice per cent. cane; by subtracting this latter figure from 100, the fibre per cent. cane was derived.

Polarisation per cent. cane was obtained by multiplying polarisation per cent. absolute juice.

With polarisation per cent. cane, fibre and apparent purity of absolute juice, the yield of commercial cane sugar can be calculated by means of appropriate formulae, the mill work being calculated from the formulæ $1 - \frac{0.4F}{100}$, where F = fibre content, and the boiling house recovery from the S.J.M. formula of Noel Deerr.

Foliar Diagnosis Studies

Samples of leaves collected in 1942 by Mr. S. Feillafé and others collected by Mr. Halais in 1944 were analysed by modern methods. Of the 117 samples so examined, 36 originated from canes grown by mill owners, 18 by big estates (without mill) and 18 by small planters, 87 from Sugarcane Research Station manurial trials and 28 from Sugarcane Research Station variety trials. In all cases the nitrogen content was determined and in 153 cases the phosphate and potash, whilst calcium and magnesium were only determined in 30 samples. Some analyses of sulphur, chlorine, silica and iron contents were also carried out.

Interpretation of results.—The key of interpretation has been worked out by correlating the nutrient contents of the leaves with the observed yield expressed as a percentage of the maximum yield obtainable by use of the optimum quantity of fertilizer supplying the nutrient under consideration.

Nitrogen.—Up to the present the number of comparisons is insufficient to warrant any definite conclusions being drawn, but it is considered that the nitrogen content on a dry matter basis of the 3rd fully expanded leaf should be between 1·4 per cent. and 1·5 per cent. for the variety M.134/32 and between 1·35 per cent. and 1·45 per cent. for Big Tanna and B.H.10/12.

Phosphate.—In this case, conclusions are drawn from 23 field experiments conducted in different parts of the island over a number of years, the observed increases (yield resulting from the application of phosphates) varying from nil per cent. to 185 per cent. For phosphate not acting as a limiting factor to cane production, it is considered that the P_2O_5 content of the selected leaf should vary between 0·44 per cent. and 0·5 per cent. for M.134/32 or between 0·36 per cent. and 0·4 per cent. for Big Tanna and B.H.10/12. Accepting these optimum limits, the increase in yield following the application of the optimum quantity of phosphatic fertilizer on lands belonging to estates with mills, would be small, only 1·3 per cent. of the present yields, whilst in the case of lands not belonging to an estate with mill the increase might be expected to be of the order of 7 per cent.

Potash.—From the results of 22 fields experiments conducted in different parts of the island over a period of years, in which the percentage of increase following applications of potash fertilizers ranged from nil per cent. to 96 per cent., it has been calculated that the optimum K_2O content of the selected leaf on a dry matter basis is between 2·35 per cent. and 2·65 per cent. for M.134/32 and 2·2 per cent. and 2·5 per cent. for Big Tanna and B.H.10/12. Working on these figures, it may be assumed that on an average the yields on lands belonging to estates with mills might be increased by 3·5 per cent. by applying the optimum quantity of potash fertilizers, whilst in the case of small planters an average increase of 13·4 per cent. might be expected. The increase in cane tonnage is accompanied by an increased sucrose content in the cane, so that if we consider sugar production per arpent the increases would amount to about 5 per cent. and 18 per cent. respectively.

Comparison between leaves taken from fields belonging to estates with mills, estates without mills, and to small planters in different climatic zones

Analyses carried out on samples taken in 1941 indicated that, in general, canes from estates with mills were better supplied with plant nutrients than those from small planters, those from estates without mills being generally intermediate. With these samples, individual analyses were performed with each of the 18 samples from the different types of holding, but in the case of nitrogen, mixed samples for each type of holding in each of the three climatic zones were analysed.

For the 1942 series, all samples were analysed individually for each of the elements N, P and K, and for other elements, Ca, Mg, S, Cl, Fe, and Si, mixed sample only were tested. The results obtained are as follows—

				1941							
Climatic zone				Type of holding		N	P ₂ O ₅	K ₂ O	CaO	MgO	SiO ₂
(1)	Sub-humid : Average 50" rain per annum			A	Estate with mill ...	1.26	0.368	2.14	0.31	0.15	
	Altitude 200'			B	Estate without mill ...	1.29	0.363	2.02	0.33	0.16	
				C	Small planters	1.26	0.357	1.89	0.33	0.17	
(2)	Humid : Average 75" rain			A	...	1.32	0.375	2.14	0.31	0.16	
	Altitude 350'			B	...	1.32	0.328	1.92	0.35	0.22	
				C	...	1.34	0.345	1.84	0.37	0.12	
(3)	Super Humid : Average 115" rain			A	...	1.40	0.385	2.16	0.43	0.19	
	Altitude 750'			B	...	1.40	0.363	1.95	0.45	0.22	
				C	...	1.31	0.348	1.82	0.40	0.28	
				1942							
Climatic zone				Type of holding		N	P ₂ O ₅	K ₂ O	CaO	MgO	SiO ₂
(1)	...	...	...	A	...	1.24	0.435	2.37	0.29	0.10	2.72
				B	...	1.25	0.370	2.27	0.29	0.15	2.68
				C	...	1.21	0.370	2.11	0.29	0.13	2.44
(2)	...	...	...	A	...	1.32	0.373	2.24	0.29	0.16	2.00
				B	...	1.25	0.348	1.97	0.30	0.26	2.04
				C	...	1.22	0.352	1.79	0.30	0.17	2.48
(3)	...	...	...	A	...	1.35	0.387	2.27	0.34	0.19	1.48
				B	...	1.25	0.357	2.03	0.42	0.26	1.80
				C	...	1.24	0.357	1.80	0.39	0.39	2.16

In the tables for 1941 and 1942, each of the figures for N, P₂O₅ and K₂O is the mean of six determinations, except in the case of nitrogen for 1941. These results may be discussed from two points of view—

(a) effect of type of holding.

(b) effect of climate.

(a) *Effect of type of holding.*—In so far as nitrogen is concerned there is some slight indication that the small planters' canes may not be so well supplied as are the mill owners canes, particularly in the moister regions. The phosphate and potash contents of the leaves of the small planters canes are however definitely lower than those from the mill-owners canes grown in the same factory area. In other words, the composition of the small planters' canes is further from the optimum than is that of the mill owners, and consequently their yields suffer correspondingly. Another point which becomes apparent from these two tables is the antagonism between the bases (K₂O, CaO and MgO). Thus it will be seen that the small planters' canes contain more calcium and magnesium than do those of the mill owner in the same factory area; this point being particularly noticeable with respect to magnesium. This difference is especially apparent in the super-humid districts where the divergence between the potash contents is most marked.

(b) *Effect of climate.*—In both 1941 and 1942, the nitrogen contents of the samples taken in the super-humid districts are somewhat higher than in the humid and sub-humid regions, and this finding is confirmed by analyses made on leaf samples taken from estate lands in 1944. With respect to the phosphate however, there is no constant difference between samples taken from estate canes in the different regions, although there is a slight indication that the P_2O_5 content of planters' canes falls with increasing precipitation. The variation of the potash content is dependent upon the type of holding, no difference being noted in the different climatic zones in the leaves from estate canes, but as rainfall increases, there is a definite lowering of the potash content of leaves from canes grown on lands belonging to estates without mills or to planters, the decrease being greatest in the latter type of holding. The general trend with respect to calcium and magnesium in the leaves is similar, but more pronounced with magnesium, the contents increasing with increased precipitation, i.e., the variation is the reverse of what happens in the case of potash. The greatest variation found, however, occurs in the silica content of the leaves from estates with mills, the results of 1942 being confirmed by others from samples taken in 1944, the silica content in the super-humid regions being only about two-thirds of that in the sub-humid districts.

Comparison of M.134/32 with M.112/34

Seven variety trials conducted by the Geneticist on estates in different parts of the island were sampled, leaves from the two above-named varieties being taken. Average figures showing their composition are given in the table below—

		N		P_2O_5		K_2O
		% DM		% DM		% DM
M.134/32	...	1.37	...	0.49	...	2.31
M.112/34	...	1.40	...	0.48	...	2.42

This indicates that the two varieties are practically the same, and that the interpretation of results may be made on the same basis.

Composition of the Cane Plant at Harvest

Samples for this work were taken during September-October 1944 from fields of 1st, 2nd, and 3rd ratoons of M.134/32, four fields being sampled on each of the same 18 estates with mill, sampled for the foliar diagnosis studies in 1941, 1942 and 1944. Consequently the samples represent the best average conditions obtaining in Mauritius, but it should be noted that owing to the destructive cyclone of April 1944, followed by drought conditions, the yields were considerably lower than would normally be expected.

The samples were taken by cutting known lengths of cane rows and weighing, so that the results can be converted from a ton of millable cane basis to one on an arpent basis: harvested cane plant was divided into four portions—

- (a) millable cane,
- (b) dry leaves or trash,
- (c) prepared fodder,
- (d) outer green leaves.

The weight of trash was estimated by counting the number of nodes on which the leaves had dried and then taking the top two completely dried leaves as representative samples. The prepared fodder plus the outer green leaves form the entire green top. These samples were analysed for the constituents mentioned in the table below, and the different constituents associated with one ton of millable canes in the various parts of the plant have been calculated. The average cane yield, estimated from the weights obtained per unit length was 23.3 tons per arpents in the fields sampled.

Kilos of plant nutrients associated with one ton of millable cane—

	(a)	(b)	(c)	(d)	(c) and (d)	Total
	<i>Millable cane</i>	<i>Trash</i>	<i>Prepared fodder</i>	<i>Outers green leaves</i>		
Fresh matter...	1,000	133	155	145	300	1,433
Dry matter ...	300	117	37	46	83	500
Water ...	700	16	118	99	217	933
N ...	0.57	0.39	0.27	0.38	0.65	1.61
P ₂ O ₅ ...	0.48	0.16	0.15	0.13	0.28	0.92
K ₂ O ...	2.10	0.82	1.01	0.79	1.80	4.72
CaO ...	0.36	0.63	0.13	0.26	0.39	1.38
MgO ...	0.45	0.17	0.12	0.14	0.26	0.88

From these tables it is seen that for one ton of cane cut in the fields, 133 kgs. of dry trash, 155 kgs. of prepared fodder and 145 kgs. of outer green leaves were also produced. In 1944, it should be remembered that the crop suffered from several adverse factors, of which the following are the more important in the present connection—

- the effect of a destructive cyclone in April followed by a drought, thus preventing efficient utilization of the plant nutrients taken up from the soil, and
- small quantities of nitrogenous fertilizers were available for this crop, resulting in a smaller intake of nitrogen.

These two factors may therefore counterbalance one another to a certain extent.

The figures given are averages for canes from 18 estates distributed throughout the whole colony, and it must be stressed that there are big deviations from these in the different climatic zones. The portion of the plant exported from the field is the millable cane, with in many cases fairly considerable proportions of the prepared fodder which is used for cattle feeding. The chief loss of plant nutrients is due to these factors, of which the millable cane is by far the more important, as this part contains approximately 50 per cent. of the N, P and K contained in the whole harvested plant. The quantities so exported may be easily calculated from the figures quoted and the average yield. As examples of the quantities so exported in the millable cane per arpent, the following figures are given—

		<i>Sub-humid districts</i>	<i>Humid district</i>	<i>Super-humid district</i>
N (in kilos per arpent)	...	15	14	12
P ₂ O ₅	do	14	10	10
K ₂ O	do	66	47	34

These figures indicate that, whenever possible, the most efficient use should be made of all residues obtained from the manufacture of sugar. Even in the case of fodder used for feeding and of trash used for litter, there are appreciable quantities of plant nutrients exported, and if the pen manure is prepared in poor conditions, there will be a further considerable loss of the soluble plant nutrients.

This work is being continued in order that good average figures may be obtained.

Chemical Fertilizer Control

The control of distribution of chemical fertilizers was continued throughout the year on similar lines to that in previous years, details being given below.

Year 1943-44.—Sugarcane: allocations were made on the basis from 70 kilos per arpent in the dry regions up to 110 kilos per arpent in the wet cold regions. Supplies were insufficient to meet the full total of the allotments, the following percentages being allowed for nitrogenous fertilizers—

Nitrate of Soda	...	...	37½%
Ammonium Chloride	...	...	45½%

A point to be noted in connection with these distributions is that all nitrogenous fertilizers, with the exception of 33½ per cent. nitrate of soda, were authorized from the middle of January 1944 onwards, and consequently the fertilizers could only be applied to the canes much later than the optimum period.

For potash fertilizers, all planters were divided into five categories, based on climatic conditions and type of holding, varying percentages being given to the categories. The authorized distribution varied between 30 per cent. for category A, and 10 per cent. for category E. In this case also the muriate of potash was only available from January, 1944 onwards.

Maize.—Delivery orders were issued to all maize growers requiring fertilizers on the basis of 25 kgs. sulphate of ammonia, 25 kgs. nitrate of soda, quantities of muriate of potash varying from 10 to 30 kgs., and 75 kgs. of phosphatic guano per arpent.

Tobacco.—Quantities of fertilizers were reserved for this crop, and permits were issued to growers by the Government Tobacco Officer.

Other crops.—Permits were issued to all growers on applications, the rate being governed by the requirements of the crops being grown. It was impossible to check all these applications, but where checks were made at intervals the applications were substantially correct.

Year 1944-45.—Sugarcane: allocations were again made on the low basis of 1943-44, but supplies of fertilizers were more abundant than in the previous year, and they were received in the Colony at a much earlier date.

Consequently the position with respect to fertilizers is much improved, and after distributions had been authorized, a consolidated distribution was made on the 2nd December 1944, according to which planters could receive the following—

Nitrogenous fertilizers:

Sulphate of Ammonia	... .	...	40%	of allotment
Ammonium Chloride	....	...	25%	"
Nitrate of Soda...	...	...	25%	"
Chilean Nitrate of Potash	...	...	25%	"

Polash fertilizers:

Muriate of potash	....	varying from 30% to 10%
		of allotment.

In addition certain categories of planters were allowed to take Indian Nitrate of Potash (+2 per cent. K_2O) instead of Chilean Nitrate of Potash (16 per cent. K_2O) on an equivalent nitrogen basis. Thus the 1945 sugar crop will have had benefit of a much increased supplies of fertilizers, both nitrogenous and potassic, which were available at the proper time. It will be seen that planters have been authorized to purchase 15 per cent. more nitrogenous fertilizers than was originally allotted to them, but these allotments were made on absolutely minimum requirement, and not on optimum requirements and consequently it is probable that applications of nitrogenous fertilizers are still inferior to normal applications.

It is interesting to note that the number of applications received for the year 1944-45 was much less than in previous years. This may be due to the fact that more planters are receiving fertilizers through the estates, middlemen, or co-operative credit societies, but it is certainly due to some extent that some small planters have simply abandoned their cane plantations or else uprooted them in order to plant food crops.

Maize.—In view of the somewhat improved position regarding stocks, the allocation of nitrogenous fertilizers was increased to 35 kilos sulphate of ammonia and 35 kilos nitrate of soda per arpent.

Food Production Scheme

This scheme was continued throughout the year, but the area to be planted was reduced from 27.5 per cent. to 22.5 per cent. due to labour shortage and to increased weed infestation of the lands selected for food-crops. More flexibility was given to the scheme, by reducing the insistence on maize plantations and thereby allowing other crops to be grown which gave a better prospect of reaping more paying crops in localities not well suited for maize growing. Moreover, winter maize plantations were greatly reduced, on account of the failure of such plantations made in 1943. Where this was done, the planters were allowed to grow vegetables, such as cabbages, cauliflowers, peas, beans, etc., the choice

of such vegetables being left to the planter himself. This may have been one reason for the very plentiful supply of certain vegetables at one time of the year. Cauliflowers, for instance, were at one time being sold at the rate of three for twenty-five cents, i.e., probably at a cheaper rate than ever before.

A strict control was kept over plantations on all estates between 20 and 200 arpents, and generally plantation orders were obeyed. In some cases, however, definite opposition was encountered, and several cases had to be reported to the Controller of Supplies.

Plantations made in the early part of 1944 made fairly good progress during January, February and March in spite of the exceptionally heavy precipitations recorded at intervals, but the cyclone of April caused very severe damage to both maize and manioc, particularly the latter. Fields of maize actually in the tasseling stage during the cyclone were also very severely mauled, the cobs when they matured being practically empty. Maize which had not yet reached this stage and that in which the cobs were maturing, was not affected to anything like the same extent, although there was still a fair reduction in yield. Manioc was almost defoliated by the cyclone, many sticks were broken, together with many of the roots.

Those roots broken or bruised quickly rotted, whilst the others were not of good quality. Later in the year it was difficult to find purchasers for this manioc, and this may be due to its poor cooking qualities. This delay in harvesting was also a cause for delay in replanting.

Plantations made in July, August and September had a good start, and there was every prospect of a good maize crop in the limited area planted. Unfortunately a very severe drought occurred from the middle of October up to the middle of December, so that many plantations were absolutely ruined, whilst in other cases the yields were reduced.

The total areas of foodstuffs planted on estates of between 20 and 200 arpents during the year were as follows—

Maize	...	...	...	2,530 arpents
Manioc	...	...	...	435 "
Sweet potatoes	...	...	...	122 "
Eddoes (Arouilles)	...	...	...	162 "

The effective control of these plantations on 277 estates was difficult, especially in view of the fact that in many cases the foodstuff area on one estate might be split up into several portions, sometimes situated in places fairly difficult of access, and credit is due to the officers concerned in this work for the manner in which they performed it.

Weed Survey

During an investigation carried out on a number of sugar estates with mills dispersed throughout the Colony, it became apparent that the weed problem was becoming so serious as to warrant a special investigation. When practically all agricultural land was under sugarcane, it was easy to keep it relatively free from weeds, one of the chief

factors obviously being that the heavy shade provided by the leaves of this crop suppressed the weeds once the crop had covered the land. When foodcrops were grown, however, the soil was never heavily shaded and consequently weeds were able to grow profusely, with the result that much land was practically abandoned.

Mr. d'Emmerez was directed to carry out a detailed survey in two localities where the situation was thought to be particularly bad, namely in Flacq and certain areas of Plaines Wilhems and Black River. The first survey was completed, but the work has now had to be postponed due to the fact that Mr. d'Emmerez has been promoted to the post of Agronomist, the duties attached to his new post not allowing him time to continue this work. The survey shows that a number of weeds are definitely of economic importance, most of them being perennials with rhizomes. The eradication of these weeds is therefore difficult and expensive by cultivation methods.

Some of the most noxious weeds are—

<i>Scientific name</i>		<i>Local name</i>
Mikaria Scandens	... ..	Liane Margoze, Liane Pauline, Liane Raisin
Cynodon dactylon	... ..	Chiendent
Echinoclos colonum	... ..	Herbe Sifflette
Iachæmum aristatum	... ..	Herbe d'Argent
Phalaris arundinaceæ	... ..	Herbe Mackaye
Ambrosia artemisifolia	... ..	Herbe Solferino
Hydrocotyl bonariensis	... ..	Herbe bol, Herbe Tam-Tam, Herbe Oreille

This short list is by no means comprehensive, but is merely given to show some indication of the nature of the weed problem. In addition to these there are many annual weeds propagated by means of seeds, but it is not thought likely that these will prove either so difficult or costly to control when the land is returned to sugarcane as those mentioned earlier.

No real experiments in controlling them by chemical means, have so far been possible, due to the lack of the necessary chemicals. Arrangements have been made however for trial quantities of the following chemicals to be supplied by the Crown Agents for the Colonies: sodium chlorate, copper chloride, di-nitro-ortho-cresol (D.N.O.C) in both the form of the sodium salt and the ammonium salt. The possibility of flaming is also being considered.

The whole problem is to be discussed by the writer with workers in England interested in this problem on his forthcoming visit to England on leave, and it is hoped to draw up a comprehensive scheme of research work, which will be started as soon as possible.

Uba Replacement Scheme

This scheme came to an official close on the 30th June, 1944. A separate report was laid before the Council of Government in February 1944 and in this report it was shown that the work of replacement had been practically completed during the crop season of 1943-44, and that no serious difficulties had been encountered. Consequently the cane situation in the areas concerned at Lallmatie and Solferino is now satisfactory, and it is incumbent upon the factories drawing cane supplies from these areas to maintain an efficient supervision in order to ensure that inferior canes are not again propagated. In this connection, I would like to suggest that estates, both with and without mills, should be particularly careful to set a good example to the small planters by refraining to plant on a large scale any varieties which may in the future be classed as inferior, e.g., Cent Tonnes Bâtard or Co.301.

The yields of canes in the two areas above-mentioned for the 1944-45 crop were as follows—

	<i>Good Canes</i>	<i>Uba Canes</i>
Lallmatie, etc. ...	65,062 metric tons	0
Solferino ...	5,874 „	0

N. CRAIG,
Senior Chemist.

